

Modification of Jupiter's Stratosphere Three Weeks After the 2009 Impact

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Infrared spectroscopy sensitive to thermal emission from Jupiter's stratosphere reveals effects persisting 3½ weeks after the impact of a body in late July 2009. Measurements obtained at 11.7 μm on 2009 August 11 UT at the impact latitude of 56°S (planetocentric), using the Goddard Heterodyne Instrument for Planetary Winds and Composition (HIPWAC) mounted on the NASA Infrared Telescope Facility, reveal an interval of reduced thermal continuum emission that extends ~60°–80° towards planetary East of the impact site, estimated to be at 305° longitude (System III). Retrieved stratospheric ethane mole fraction in the near vicinity of the impact site is enhanced by up to ~60% relative to quiescent regions at this latitude. Thermal continuum emission at the impact site, and somewhat west of it, is significantly enhanced in the same spectra that retrieve enhanced ethane mole fraction. Assuming that the enhanced continuum brightness near the impact site results from thermalized aerosol debris, then continuum emission by a haze layer can be approximated by an opaque surface inserted at the 45-60 mbar pressure level in the stratosphere in an unperturbed thermal profile, setting a lower limit on the altitude of the top of the ejecta cloud at this time. The reduced continuum brightness east of the impact site can be modeled by an opaque surface near the cold tropopause, consistent with a lower altitude of ejecta/impactor-formed opacity or significantly lesser column density of opaque haze material. The physical extent of the observed region of reduced continuum implies a minimum average velocity of 21 m s^{-1} transporting material prograde (East) from the impact. Spectra acquired further East, with quiescent characteristics, imply an average zonal velocity of less than 63 m s^{-1} . This work was supported by the NASA Planetary Astronomy Program.